Raymond Concrete Piling

RAYMOND CONCRETE PILE COMPANY

CONCRETE PILE CONSTRUCTION

MORTON D. HULL
PRESIDENT

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TREASURER

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**MERCHANTS LOAN & TRUST BUILDING
CHICAGO : U. S. A.**

THE Raymond Systems of Concrete Piling are fully protected by Letters Patent of the United States and of all the principal foreign countries. Any infringements will be prosecuted to the fullest extent of the law.

The Raymond System

RAYMOND CONCRETE PILES have been used successfully, since their introduction in 1901, by a large number of architects and engineers of high standing throughout the United States, including engineers of the United States Government. The most rigid tests have been imposed, and the results have been in all cases more than satisfactory. Their use has not been confined to any particular locality, nor to any particular kind of soil, but they have proven of great value and economy from New York to Colorado, and in soils of all kinds—dry sand, quicksand, clay, mud, silt, and filled ground.

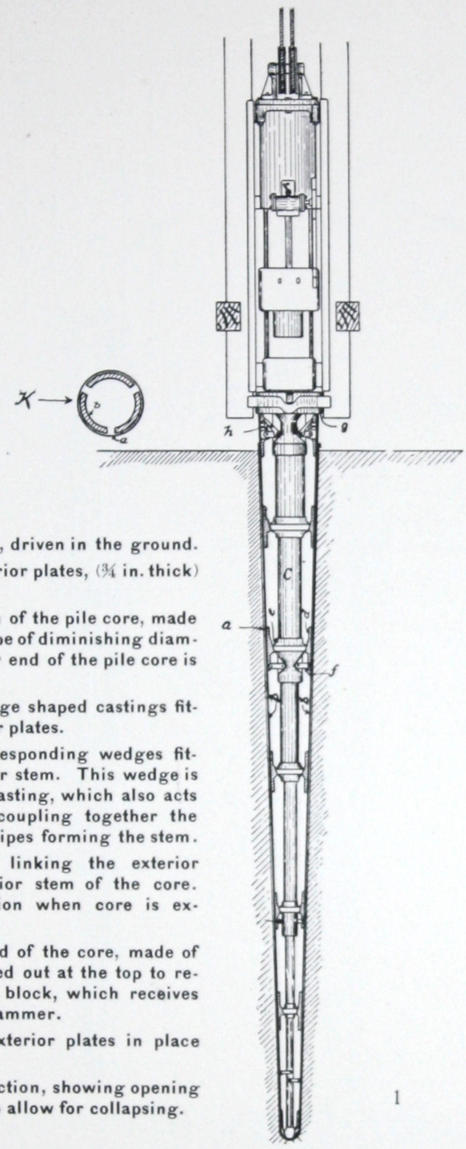
Concrete piling is undoubtedly the piling of the future and will be used more and more as it becomes more widely known. For the entire success of concrete piling it is all-important that the system used should be based on sound mechanical and engineering principles. We believe that a *thoughtful* perusal of this catalogue will convince all thorough investigators of the undoubted superiority of the Raymond System. We are certain that those who have most carefully examined the entire subject of concrete piling are most appreciative of the Raymond System and of the value of the perfect monolithic pile which is always assured by that system and by no other.

The Method.

Raymond Concrete Piles are usually put in by either of two methods—the jetting method, or the pile core method.

The jetting method is described on page 8 of this catalogue. It is adaptable only to soils such as sand, quicksand, silt, etc., which will flow readily under a water jet.

The pile core method, which is the method more generally used for foundation work, may be briefly described as follows: A collapsible steel pile core, conical in shape (see p. 5), is encased in a thin, tight-fitting metal shell. The core and shell are driven into the ground by means of a pile driver (preferably fitted with a steam hammer). The core is so constructed that when the desired depth has been reached it is collapsed and loses contact with the shell, so that it can be easily withdrawn, leaving the shell or casing in the ground to act as a mould or form for the concrete and to prevent the admixture of extraneous matter. When the core is withdrawn, the shell or casing is filled with carefully mixed Portland Cement Concrete, which is thoroughly tamped during the filling process.



a represents the shell, driven in the ground.

b represents the exterior plates, (3/4 in. thick) of the pile core.

c represents the stem of the pile core, made of extra heavy pipe of diminishing diameter as the lower end of the pile core is approached.

d represents the wedge shaped castings fitted to the exterior plates.

e represents the corresponding wedges fitted to the interior stem. This wedge is made of a steel casting, which also acts as a collar for coupling together the various sizes of pipes forming the stem.

represents hinges linking the exterior plates and interior stem of the core. Note their position when core is expanded.

g represents the head of the core, made of cast steel hollowed out at the top to receive an oak cap block, which receives the blow of the hammer.

h keys to keep the exterior plates in place when expanded.

k represents cross section, showing opening between plates to allow for collapsing.

Fig. 1. Sectional view of Raymond pile core, showing collapsing and expanding device. (Steam hammer in the leads resting upon the core). In this illustration the shell is driven and the core expanded.

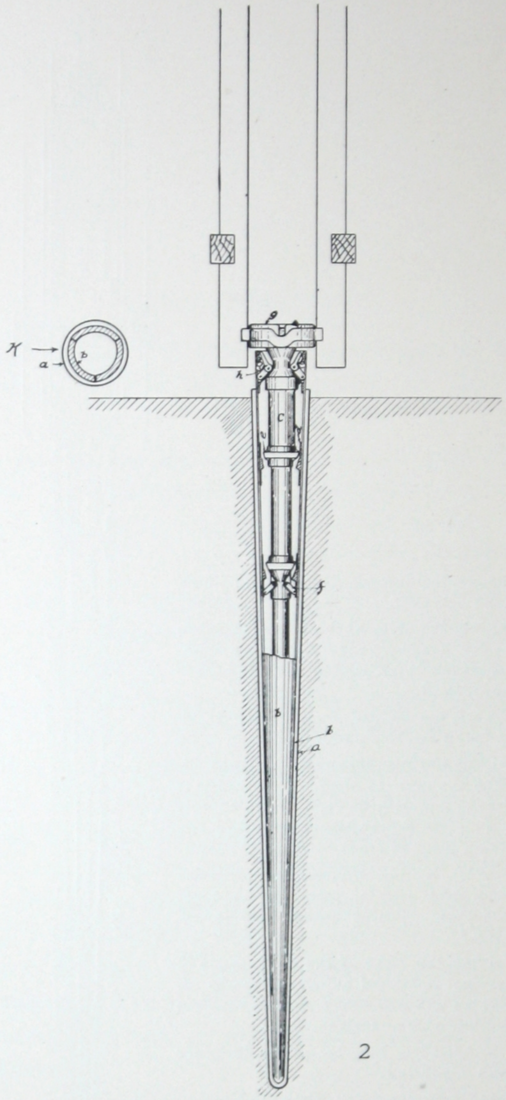


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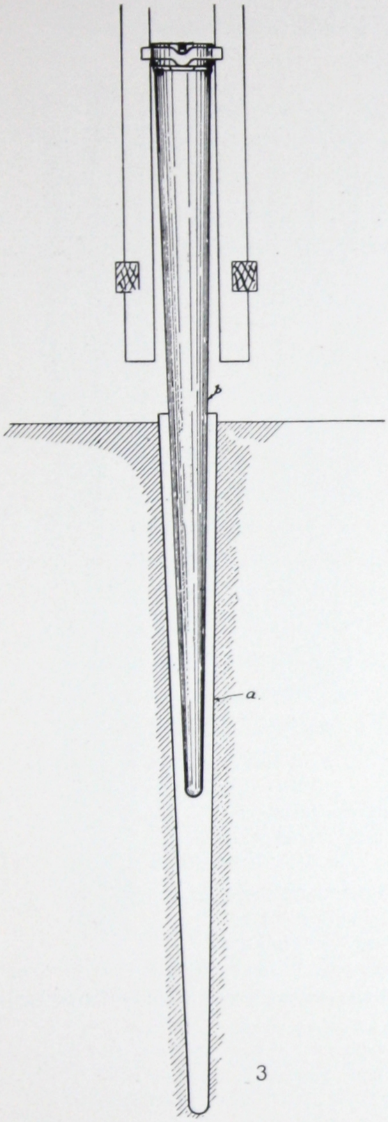
Fig. 2. Sectional view of pile core collapsed and ready to withdraw from the shell.

Note that wedges *d* and *e* are no longer in contact, thus allowing the plates *b* to collapse toward centre of core, leaving a space between plates *b* of core and shell *a*. Note also position of hinges *f* when core is collapsed.



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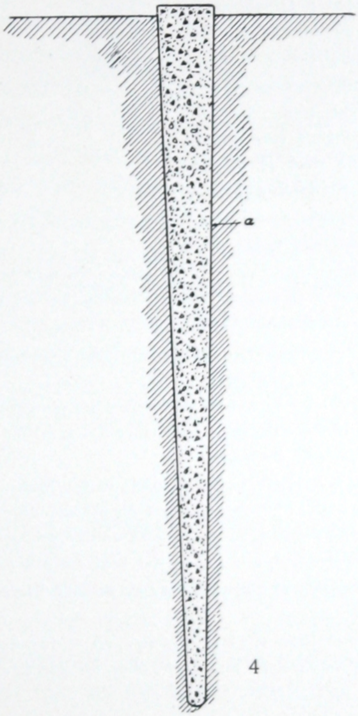

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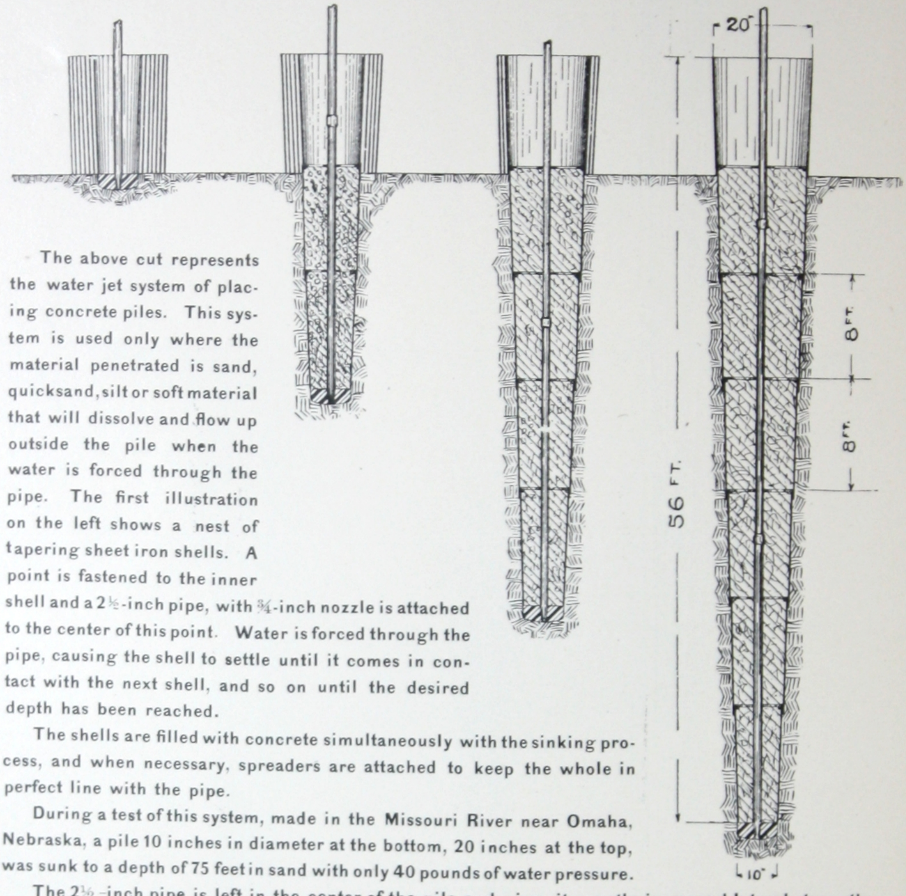
Fig. 3. Pile core collapsed and partly withdrawn from the shell. The shell remains in the ground and forms a mould for the concrete, assuring a perfect pile.

Fig. 4. A completed Raymond Concrete Pile, without reinforcement.



The above cut represents the water jet system of placing concrete piles. This system is used only where the material penetrated is sand, quicksand, silt or soft material that will dissolve and flow up outside the pile when the water is forced through the pipe. The first illustration on the left shows a nest of tapering sheet iron shells. A point is fastened to the inner shell and a 2½-inch pipe, with ¾-inch nozzle is attached to the center of this point. Water is forced through the pipe, causing the shell to settle until it comes in contact with the next shell, and so on until the desired depth has been reached.

The shells are filled with concrete simultaneously with the sinking process, and when necessary, spreaders are attached to keep the whole in perfect line with the pipe.

During a test of this system, made in the Missouri River near Omaha, Nebraska, a pile 10 inches in diameter at the bottom, 20 inches at the top, was sunk to a depth of 75 feet in sand with only 40 pounds of water pressure.

The 2½-inch pipe is left in the center of the pile and gives it greatly increased lateral strength. desired, the lateral strength may be further increased by inserting rods near the outer surface of the concrete.

By this method piles of any size up to two feet in diameter at the bottom and four feet at the top can be put in through any depth of water and to a suitable penetration in sand or silt.

The Points of Excellence of the Raymond System.

The superiority of the Raymond Concrete Pile over any other form of concrete piling consists in (1) the use of a shell or form for each pile, (2) the tapering shape of the pile, (3) the ease of reinforcement, (4) the comparative rapidity of work, (5) no driving on the concrete.

The Shell. To all who have given the matter careful consideration, it is very evident that the Raymond System of Concrete Piling is the only one that can be depended upon absolutely to meet all requirements, even under adverse conditions. There is *always* a *form* or *mould* for the concrete. What careful architect or engineer would place green concrete in quicksand, silt, mud, or any porous or unstable soil without protecting it with a form? How much more important, therefore, it is to protect the concrete which is placed in such material under ground, where there is often great pressure! With the Raymond Concrete Piles it is always possible to ascertain that the hole is a perfect one, and thus to be certain of a perfect pile. This is not possible with a concrete pile which does not use a shell. With the Raymond System *there is no working in the dark.*

Numerous experiments have been made in an endeavor to put in concrete piles without a protecting form, but in most instances they have proven unsuccessful. In sand and quicksand it was found that the concrete mixed with the sand or quicksand to an extent that made their use unsafe. In cinders and filled ground, it was found that the cement had run out into the surrounding material and left only sand and stone instead of concrete. In other soil it was found that when the work was finished, while the hole was filled, apparently with concrete, it had re-

quired but two-thirds as much concrete as the cubic capacity of the hole.

The Tapering Shape. For most foundation work it has been found, by careful experiment, that large tapering piles are the best and most economical. Where it is necessary to use piling, the ground is usually of a rather poor character, except perhaps on the surface. By using large, tapering concrete piles, 18 in. or 20 in. in diameter at the top and 6 in. or 8 in. in diameter at the point, a very much less number of lineal feet of piling is required than if straight piles are used. The superior bearing power of a tapering pile over a straight pile is particularly demonstrated where it is found that there is a hard surface stratum of ground underlaid by softer material. The straight pile will, under such conditions, drive comparatively hard till it has entirely penetrated the hard stratum above, when it will drive very easily for a considerable depth, the friction being relatively slight because the pile is straight. On the other hand, the tapering pile may, in such soil, drive comparatively easily at first, because of the small size of the point. But as it is driven further into the ground, it will drive harder and harder with each blow of the hammer, whether it has penetrated entirely through the upper stratum or not, since from its tapering shape it has to increase the size of the hole for the entire distance of its penetration into the ground. The full bearing value of the soil is thus taken advantage of by a tapering pile, and what seems relatively poor soil may be found to have a great sustaining value. The value of tapering concrete piles has been attested by the Government Engineers at the new Naval Academy buildings at Annapolis, Md., where careful tests were made and where large tapering Raymond Concrete Piles were used in place of a much greater number of very much longer wooden piles.

Ease of Reinforcement. The reinforcement of concrete piles by steel rods is sometimes found desirable for certain uses. This is always a simple matter with the Raymond System. Whether the shell or casing, which is always used, is jetted into place or driven, the insertion of the reinforcing material is done when the concrete is put in, and is simple, is in plain sight, and requires no unusual skill.

Rapidity of Work. As time is money, and as the largest item of cost of a concrete pile under any system is the labor cost, the comparatively greater rapidity of work under the Raymond System than under any other will commend itself to everyone. As speed of work is always more or less governed by local conditions, such as the length and spacing of the piles and the character of the soil to be penetrated, it is not possible to give exact figures suitable to all conditions. But, in making comparisons with other methods, one must note that in the use of the Raymond Pile Core method, after a tapering shell or casing has been driven, there is no slow and laborious withdrawing of the pile core, against the frictional resistance of the earth. As soon as the shell is driven, the core is collapsed or reduced in its diameter for its entire length, so as to lose contact with the shell, and is easily and quickly lifted out, ready to drive the next shell, without waiting for the filling of the one already driven. Under favorable conditions fifteen 20-ft. Raymond Concrete Piles have been put in in two and one-half hours. And in moderately hard driving, requiring from 400 to 500 blows of a No. 2 Vulcan steam hammer, thirty-seven 20-ft. Raymond Piles have been put in in one day with a single driver.

The Driving. Numerous attempts have been made to build and afterward drive the actual concrete pile. But these attempts have met with but a limited success. Such piles require in their manufacture heavy reinforcement with steel rods, which makes them expensive, and when driven they cannot stand a hard blow of the hammer without fracture. Under the Raymond System there is no driving on the concrete. A steel pile core, carrying a sheet-metal shell, is driven as described on page 4; the core is then withdrawn, and the shell afterward filled with concrete, which sets or hardens in place.

Economy.

As Raymond Concrete Piles are made where they are used, their cost varies, depending upon the cost of transporting machinery to the site, the availability of material, the character of the soil to be penetrated, the number and spacing of the piles, and the general labor conditions of each locality.

While concrete piles necessarily cost more per lineal foot than wooden piling, the economy in the use of concrete piles as against wooden piles is very considerable. It is due, first, to the much smaller number of concrete piles required to carry the necessary load, one concrete pile having, on account of its great size and taper, practically the carrying capacity of three ordinary wooden piles of the same length; and, secondly, to the great saving of excavation and masonry so generally required where wooden piles are used.

The illustrations on pages 14, 15 and 16 show very fully the saving effected.

As to the economy in the use of Raymond Concrete Piles, we refer to the letters of architects contained in this catalogue. In the work done for the United States Naval Academy at Annapolis, a saving of more than $27,000

was made over the estimated cost of a foundation using wooden piles according to the original plan. The following table, taken from an article by the Inspector in charge of this work, published in the Engineering Record of March 4, 1905, shows how this saving was effected:

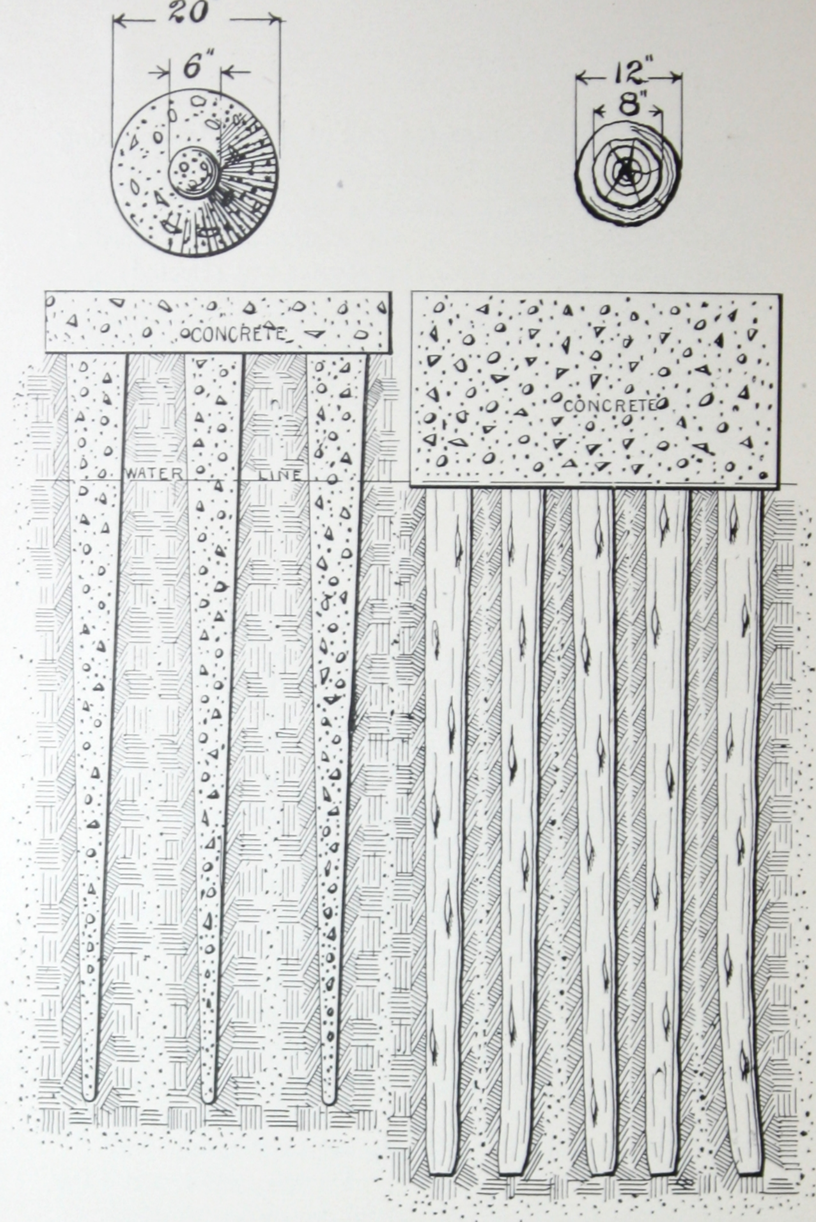
COMPARATIVE COST OF WOOD AND CONCRETE PILES.

Wood Piles.

2,193 piles	at $9.50	$20,835.50	
4,542 cubic yds. excavation	" .40	1,816.80	
3,250 " " concrete	8.00	26,000.00	
5,222 lbs. I-beams	.04	208.88	
Shoring and pumping		4,000.00	
Total cost			$52,861.18

Concrete Piles.

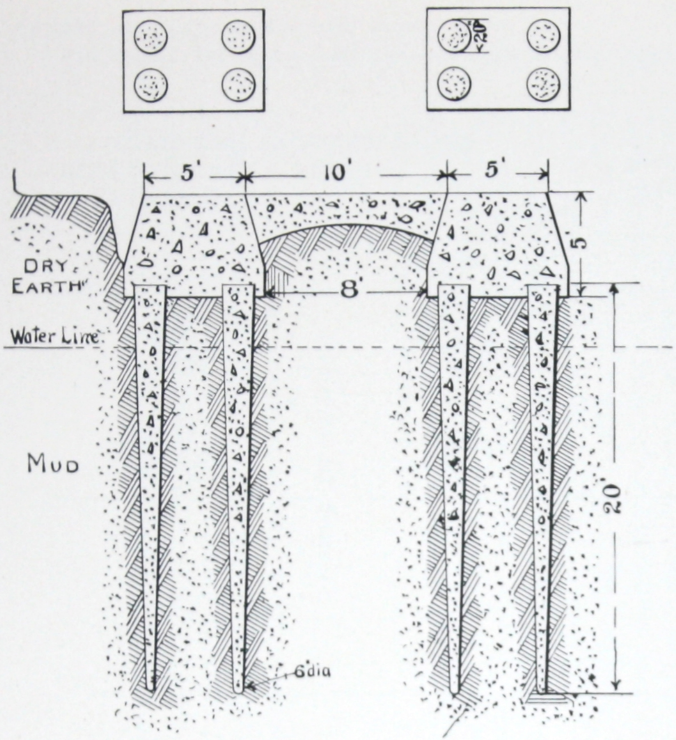
855 piles	at $20.00	$17,100.00	
1,038 cubic yds. excavation	" .40	415.00	
986 " " concrete	" 8.00	7,888.00	
Shoring and pumping		....	
Total cost			$25,403.00
Saving by use of Concrete Piles			$27,458.18



COMPARISON OF
CONCRETE PILE
WITH WOODEN PILE

Ordinary wooden piles average about 12 inches in diameter at the top and have 113 square inches of surface. Concrete piles, 20 inches in diameter at the top, have 314 square inches of surface, or 2.77 times that of the wooden pile. The taper of a wooden pile is only about three or four inches from top to bottom, while the taper of the concrete pile is from 10 to 14 inches.

The above illustration gives a fair representation of what may be saved by the use of concrete piles. The three concrete piles, each 20 inches in diameter, have a bearing surface of 942 square inches, while the five wooden piles, each 12 inches in diameter, (which is a fair average) have a bearing surface of 565 square inches. Note the additional concrete required on top of the wooden piles, which must be cut off below water line to insure their permanency. It is also frequently necessary to drive sheet piling around the trenches in order to make the excavation to water line.



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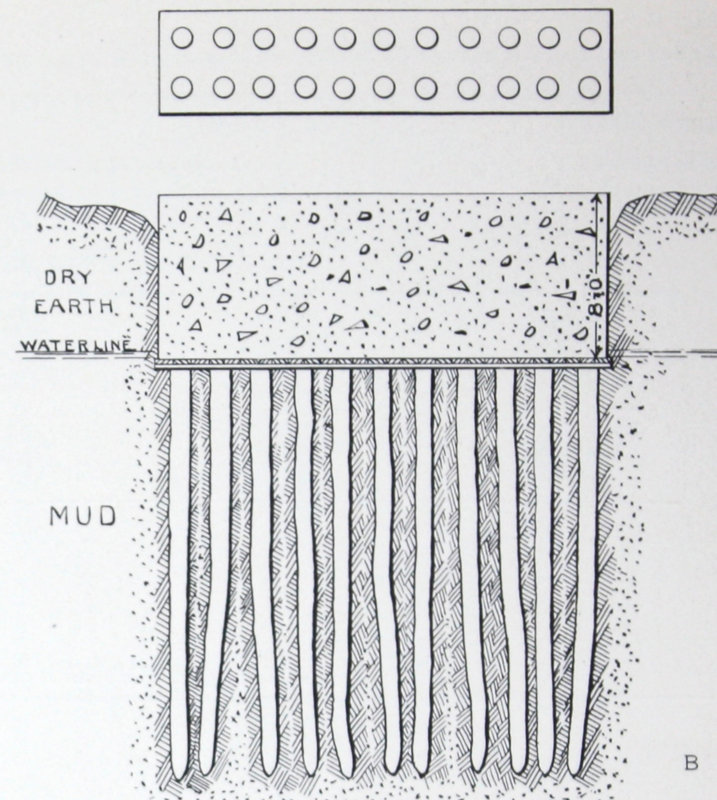
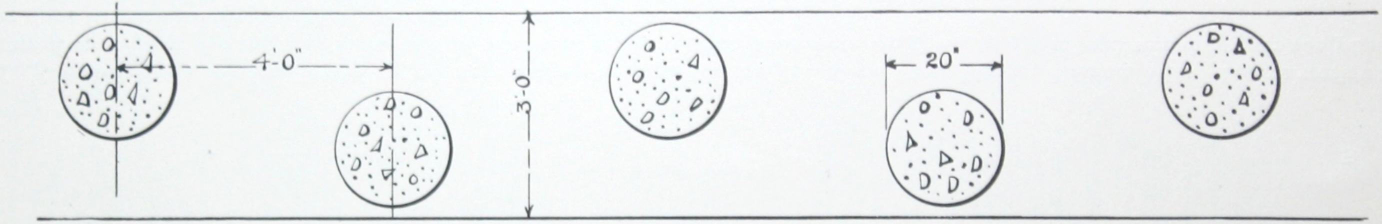


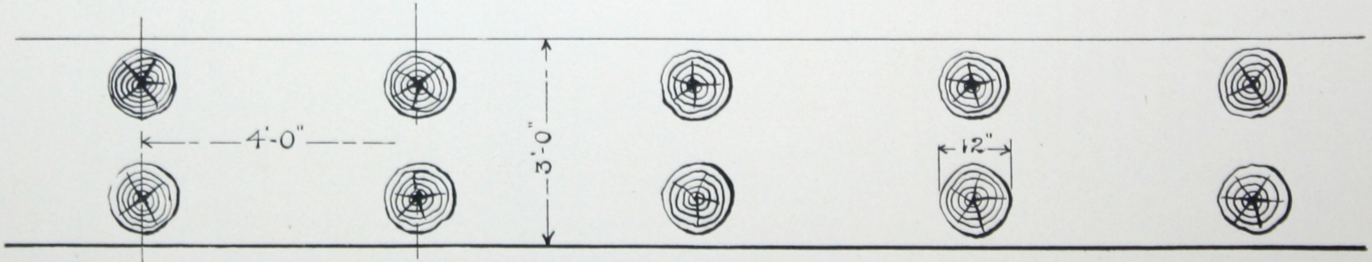
B

A. Concrete piles in piers joined by concrete arches, as built for the J. I. Case Plow Works, Racine, Wis. In this work we guaranteed to sustain the required load. Single piles and a pier of four piles were weighted, the test load remaining on the piles for six days in each instance, without showing any settlement whatever.

B. Contemplated wooden pile plan for the same building, the cost of which would have been fifty per cent. more.



5. CONCRETE PILES 1570 SQ.IN. BEARING SURFACE.



10 WOOD PILES 1130 SQ.IN. BEARING SURFACE.

COMPARISON OF
FIVE CONCRETE PILES
WITH TEN WOODEN PILES

Bearing surface of 5 concrete piles,	- -	1,570 square inches
Bearing surface of 10 wooden piles,	- - -	1,130 square inches
Difference of	- -	440 square inches

in favor of 5 concrete piles over twice as many wooden piles.

The center line of the wall has a bearing on each concrete pile. The foundation of the Bryson apartment building (see page 26), Chicago, was built on the plan shown above.

Comparison of Head Surfaces.

On account of its great taper the Raymond Concrete Pile has a marked advantage in point of economy over all other piles, whether concrete or wood. The following comparison of the head surfaces of piles of different diameters will be of interest:

	Head Surface.
One 20-inch Raymond Pile, - -	**314.16 sq. in.**
One 12-inch pile, - - - -	113.09 " "
Three 12-inch piles, - - - -	339.27 " "
One 14-inch pile, - - - - -	153.93 " "
Two 14-inch piles, - - - -	307.86 " "
One 16-inch pile, - - - - -	201.06 " "
Two 16-inch piles, - - - -	402.12 " "

It will be noted that a 20-inch Raymond pile has 314.16 square inches of head surface, while a 12-inch pile has but 113.09 square inches, a 14-inch pile but 153.93 square inches and a 16-inch pile but 201.06 square inches. It will be seen further that three 12-inch piles have but 339.27 square inches of head surface, or only 25.11 square inches more than one 20-inch Raymond pile; that two 14-inch piles have but 307.86 square inches, or 6.30 less than one 20-inch Raymond pile; and that two 16-inch piles have but 402.12 square inches, or only 87.96 more than one 20-inch Raymond pile.

Standard Sizes.

In all the foregoing illustrations, comparison is made with a concrete pile having a diameter of 20 inches at the top. If the Raymond method of jetting concrete piles is used, the diameter both at the top and at the point of the pile can be made to suit the conditions of the work. If,

however, the pile core method is used, the dimensions of the standard sizes of concrete piles are as follows:

20 ft. long,	20 inches at the top and	6 inches at the point.
25 " "	20 " " " "	8 " " "
30 " "	20 " " " "	8 " " "
35 " "	18 " " " "	8 " " "
40 " "	18 " " " "	8 " " "

For all ordinary foundation work where it is not required to go to rock or hard pan, the experience of the Raymond Concrete Pile Company has demonstrated that it is preferable to use the 20-foot length, and if necessary to increase the number of piles, rather than to increase their length, the shorter pile with its greater taper having a greater bearing value per lineal foot of piling than the longer pile. Under such conditions three 20-foot piles have a greater bearing capacity than two 30-foot piles.

Carrying Capacity.

We are often asked to state just what load may safely be placed on a Raymond Concrete Pile. It is manifestly impossible to furnish a table accurately showing the carrying capacity of piles, as the soil is not exactly the same in any two places. All tests which we have made, or which have been made by the architects and engineers on our work, indicate, however, that from two to three times as much can be placed upon a Raymond Concrete Pile as upon an ordinary wooden pile of the same length under the same conditions. The following quotation from the article by the Inspector in charge of the Naval Academy work at Annapolis (see illustrations on pages 27 to 30 of this catalogue) bears on this point:

> "The difference in bearing power between a conical and cylindrical pile was shown by an experiment tried on this work at the Naval Academy. A Raymond pile core tapered from 6 in. at the point to 20 in. at the head, was driven 19 ft. until the penetration

under two blows from a 2,000-lb. hammer falling 20 feet was 7-8 in. A wood pile 9 1-2 in. at the point, and 11 in. at the head and having the same length, 19 ft., as the conical pile, had a penetration of 5 5-16 in. under two blows of the same hammer, falling 20 ft. This pile was driven after the concrete pile and about 2 ft. from it, thus showing the comparative bearing power between a conical and a cylindrical pile of the same length.

* * * * * * * * * * * *

"Tests were made by loading the [concrete] piles, and it was estimated that all piles with the same penetration as the test piles would have the same bearing power. A 17 1-2-ft. pile driven with a 20-ft. core, 6 in. in diameter at the point and 20 in. at the head, having a penetration of 1 in. under twenty blows of a steam hammer, was loaded with 41 tons. Levels were taken during the loading and at intervals for one month. At the end of the month the total settlement was 0.007 ft. or 3-32 in.

"Another 28 1-2 ft. pile was driven with a 30-ft. core, 6 in. at the point and 20 in. at the head, had a penetration of 5-16 in. under ten blows with the steam hammer. The pile was loaded with 42 tons. Levels were taken during the loading, showing a settlement of 0.002 ft., and at intervals for one month, showing no additional settlement. This pile was driven outside of the old sea wall in that portion of the land reclaimed from the Severn River, which had been filled with sand and mud three years previously.

"A test pile was driven at the northerly end of the building on that part of the ground reclaimed from the Severn River. This pile was driven with a 30-ft. core, a distance of 22 1-2 ft., having a penetration of 1 in. for eight blows with the steam hammer. The diameter of the pile was 6 in. at the point and 16 in. at the head. It was loaded with 41 tons and had a settlement of 0.007 ft., or 3-32 in. Ten days later it showed a total settlement of 0.009 ft. The load was then increased to 45 tons, with no additional settlement, and finally, it was increased to 66 1-2 tons, showing a total settlement of 0.035 ft., or less than 7-16 in. There was no additional settlement when the load was removed six days later." (See illustration, page 30).

Cost.

Obviously, it is not possible to make fixed or standard prices for Raymond Concrete Piles, as the cost varies widely according to the conditions in each particular case; and so necessary is a knowledge of such conditions in

making estimates, that we refrain from giving any figures here, even in a general way. We are always glad, however, to furnish plans for foundations with Raymond Concrete Piles, upon receipt of the general foundation plans, with complete data as to soil conditions, loads to be carried, etc. We will also, upon request, send a representative anywhere at any time, at our own expense, to figure on prospective work.

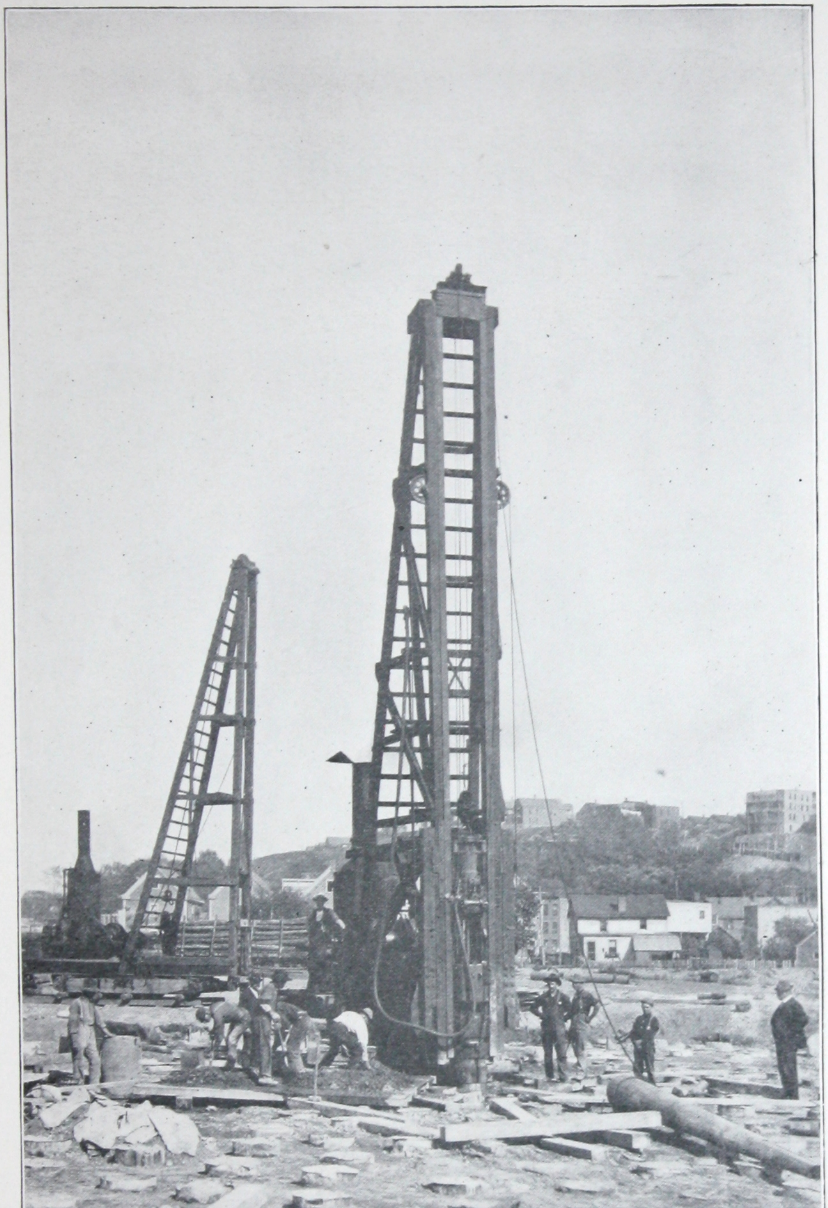
Equipment.

The Pile Core Method. The necessary equipment for constructing concrete piles according to the Raymond Pile Core Method, aside from the pile driver (which preferably in this work should be fitted with a steam hammer), consists of

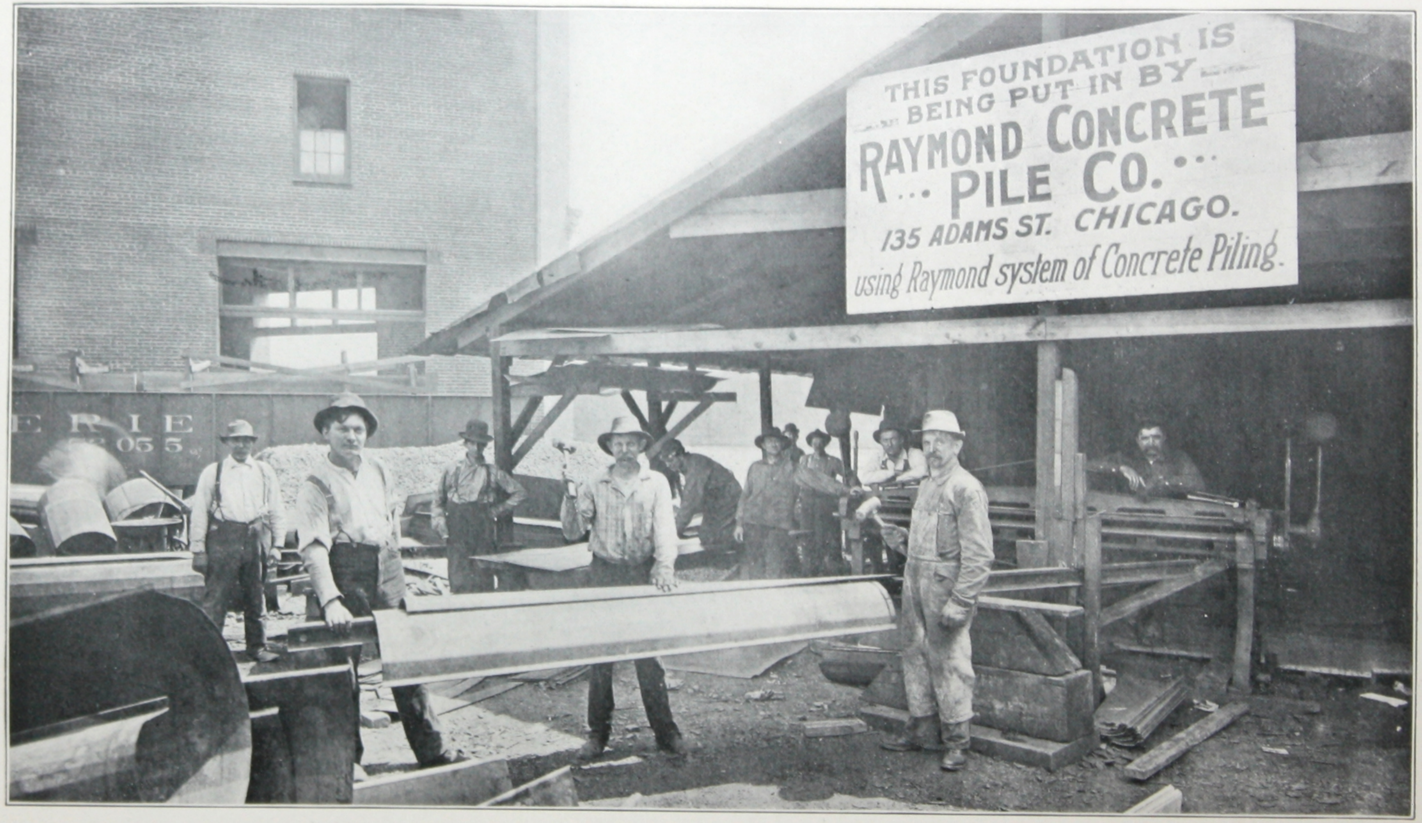
1. The Core;
2. A quantity of sheet iron for making shells, usually No. 20 gauge;
3. A heavy cornice break for bending the sheet iron to shape, with the usual complement of shears and mallets for cutting and seaming the iron.

Raymond Pile Core and Shell. A shell is driven for every pile and left in the ground to form a perfect mould for the Concrete.

Raymond Pile Core encased in shell, ready to be driven.



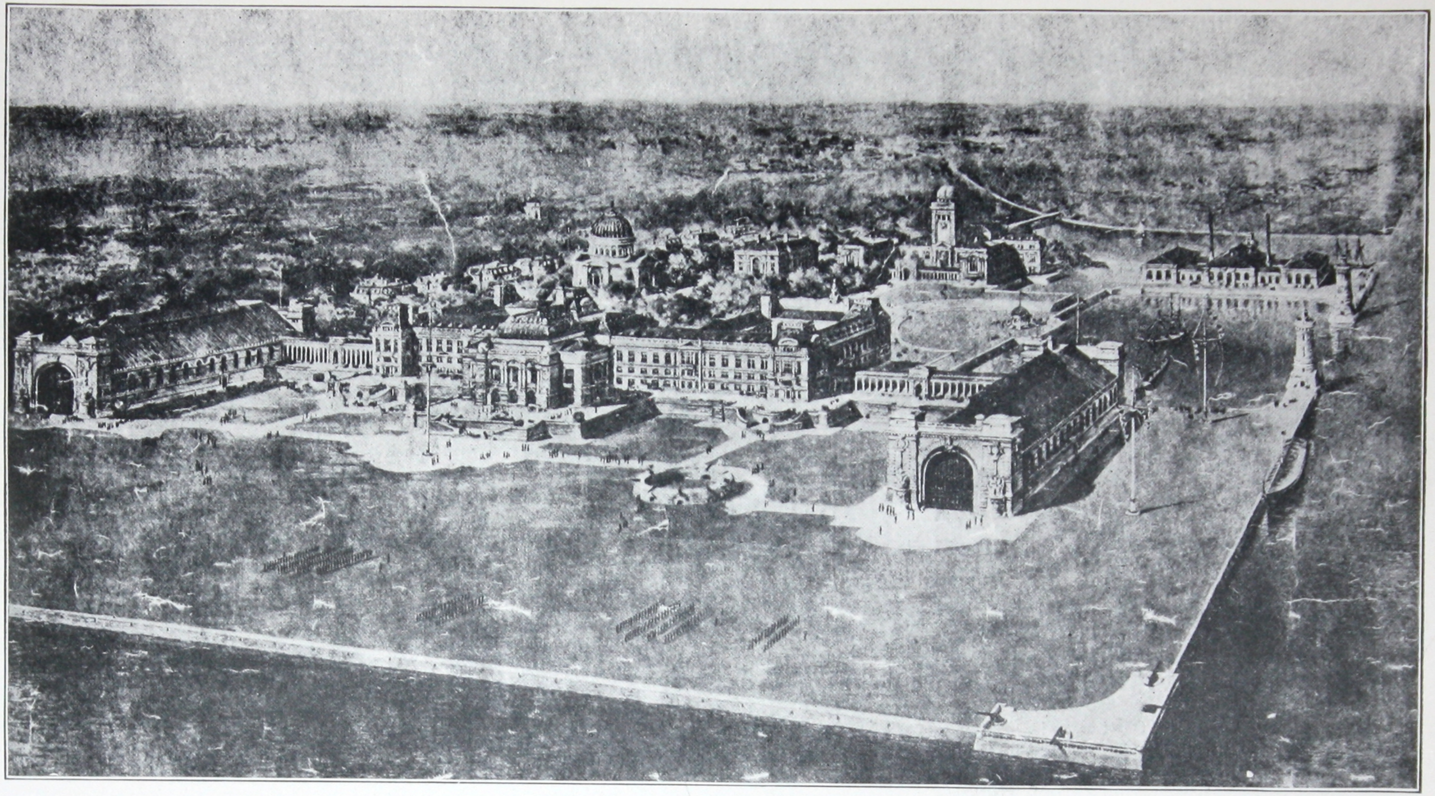
Raymond Pile Core and Shell fully driven. Core will be withdrawn and Shell filled with Concrete. The shell makes it possible to see that the hole is a clean and perfect one, thus insuring a perfect pile. No working in the dark.



Making shells for Raymond Concrete Piles. Cornice brake for forming shells in background.

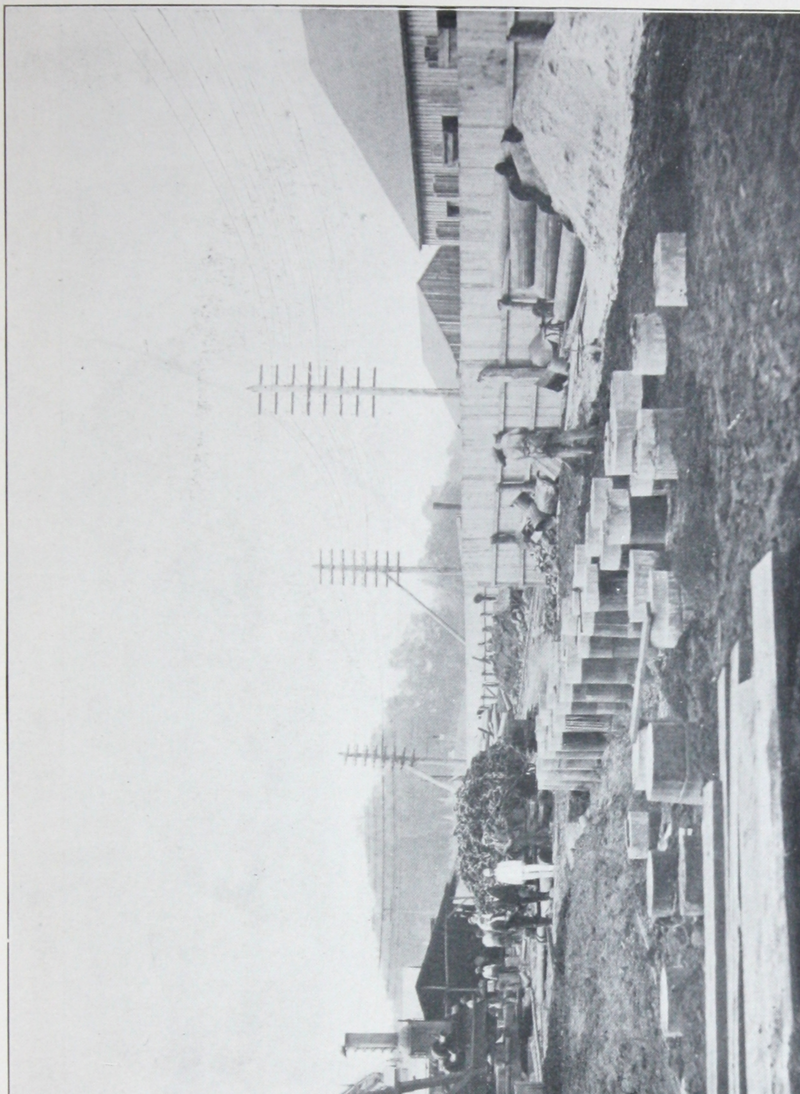
A pier of 20-inch Raymond Concrete Piles. Shell has been removed from the top 6 inches of the pile, so that it will have a perfect bond with the concrete of the footing.

Bryson Apartment Building, Lake Ave., Chicago. S. S. Beman, Architect. The first building to be built upon concrete piles. The architect is authority for the statement that there has been no settlement of this foundation.



General perspective of the new United States Naval Academy at Annapolis. Ernest Flagg, New York, Architect. Raymond Concrete Pile foundations under several of the buildings.

Raymond Concrete Piles in foundation of Library Building, United States Naval Academy, Annapolis, Md.



Raymond Concrete Piles in foundation of Academic Building, United States Naval Academy, Annapolis, Md.

Raymond Concrete Pile 22 feet six inches long, driven in sand and clay fill, soft bottom, weighted by Government Engineers in Academic site with 133,270 lbs. (See page 19). Very slight settlement. This proves the advantage of a large, tapering pile over a straight pile.

JOHN PEIRCE, PRESIDENT
HENRY S. LANPHER, V. PRES'T & TREAS.
EMIL DIEBITSCH, C.E., V. PRESIDENT.
WALTER ROBERTS, ASST. TREAS.
PETER A. GAGE, SECRETARY.

JOHN PEIRCE COMPANY

BROADWAY CHAMBERS. 277 BROADWAY

(TELEPHONE 3102 FRANKLIN)

NEW YORK May 24, 1905.

Raymond Concrete Pile Co.,
135 Adams Street,
Chicago, Ill.

Dear Sirs:-

In regard to the concrete piles, which you drove for us in the foundation of the Academic Group of buildings at the U. S. Naval Academy, Annapolis, Maryland, we are very willing to bear testimony to the saving in labor, time and money due to the substituting of concrete piles for wooden piles in these foundations.

The original plans called for 2200 wooden piles cut off below low water with a capping of concrete about 3300 cubic yards-to bring the foundations to grade. To get down to the low water level required sheet piling, shoring and pumping and the excavation of nearly 5000 cubic yards of earth.

By substituting your concrete piles the work was reduced to driving 850 concrete piles, excavating 1000 cubic yards of earth and placing 1000 cubic yards of concrete.

A comparison of quantities will give at a glance the saving in time and money achieved. The piles stood the severe test of the U. S. Government officials without the slightest indication of failure.

The foundations as built are eminently satisfactory to us, to the Architect and to the U. S. Government officers.

Yours truly,
John Peirce Company.
Emil Diebitsch
Vice-President.

DS

A trench of Raymond Concrete Piles for wall of the Crunden-Martin Woodenware Company's warehouse, St. Louis, Mo.

Foundation for the Crunden-Martin Woodenware Company's warehouse, St. Louis, Mo. 1,000 Raymond Concrete Piles used in this Foundation. The buildings in the background are also built upon Raymond Concrete Piles.
Mauran, Russell & Garden, St. Louis, Architects. (See letter on page 34).

MAURAN, RUSSELL & GARDEN,
ARCHITECTS,
CHEMICAL BUILDING,
ST. LOUIS

CABLE ADDRESS
"MARGY ST LOUIS."

May 23rd, 1905.

Raymond Concrete Pile Company,

135 Adams Street, Chicago.

Dear Sirs:--

We take great pleasure in expressing to you our appreciation of the utility, effectiveness and structural character and quality of your concrete pile work installed at the Crunden-Martin Woodenware Company's new plant in this city. We have done considerable pile work in St. Louis and have found nothing which so thoroughly fits local conditions as your concrete pile.

We take pleasure in expressing also our appreciation of your courtesy and willingness to assist in overcoming difficulties. We deem the use of your piles effects a considerable saving over other similar forms of construction and the entire system has our commendation.

Very truly yours,

Mauran Russell & Garden.

Free Public Library, Council Bluffs, Iowa. Built upon Raymond Concrete Piles. Patton & Miller, Chicago, Architects.

Klotz Building, built for the Troy Laundry Machinery Company, Twenty-third and La Salle Streets, Chicago. Built upon 1,100 Raymond Concrete Piles. Jenney, Mundie & Jensen, Chicago, Architects. (See Letter on page 37).

JENNEY, MUNDIE & JENSEN
ARCHITECTS
1401 NEW YORK LIFE BUILDING
171 LASALLE STREET
CHICAGO

W. B. MUNDIE
E. C. JENSEN
R. G. OWEN

TEL. {CENTRAL 1742
AUTOMATIC 2701

SUBJECT:- Klotz Bldg.

Chicago, May 22, 1905

Raymond Concrete Pile Co.,

Gentlemen:-

Complying with your verbal request of today, we take pleasure in expressing our views in writing, of the concrete piles at the Klotz Bldg: When we first considered foundations for this building, we were faced with the bad condition of the soil which was very wet and soft and contained considerable quick sand. Inasmuch as it was unnecessary to put in a basement, we felt that it would be economy to use your concrete piles, which was done with economy and satisfactory results.

Yours respectfully,

Jenney, Mundie & Jensen,
By E. C. Jensen

Warehouse of the Eldridge & Higgins Company, Marietta, Ohio. Raymond Concrete Pile foundation. Richards, McCarty & Bulford, Columbus, O., Architects. (See letter on page 39).

RICHARDS · McCARTY · & BULFORD
ARCHITECTS
RUGGERY BUILDING COLUMBUS O

May 19th, 1905.

Raymond Concrete Pile Co.,
135 Adams St.,
Chicago, Ill.

Gentlemen:-

Replying to your inquiry of the 18th, would say, it affords us pleasure to state, that the concrete piling you put in for us under the foundation of the Eldridge & Higgins Company's warehouse at Marietta, Ohio, has proven perfectly satisfactory in every respect.

We were confronted when we began the construction of this building with a very serious proposition. It was located on filled ground over what had formerly been a swamp. We could not use wood piling on account of the fact that we could not get it below the water level. After careful investigation we concluded to try your piling and the result has been extremely satisfactory. We consider that the use of your piling has saved us at least $3000 in concrete work. The building has been in use for several months, is heavily loaded and there is not the least indication of a settlement in any part of it, although about one half of the building is on piling and the other half on solid ground outside of the limits of the filing and the swampy soil. We consider this even a better test than had the foundation been uniform over the entire area.

We shall bear you in mind for future work and if we can be of any service to you at any time we would be glad to do so.

Yours very truly,

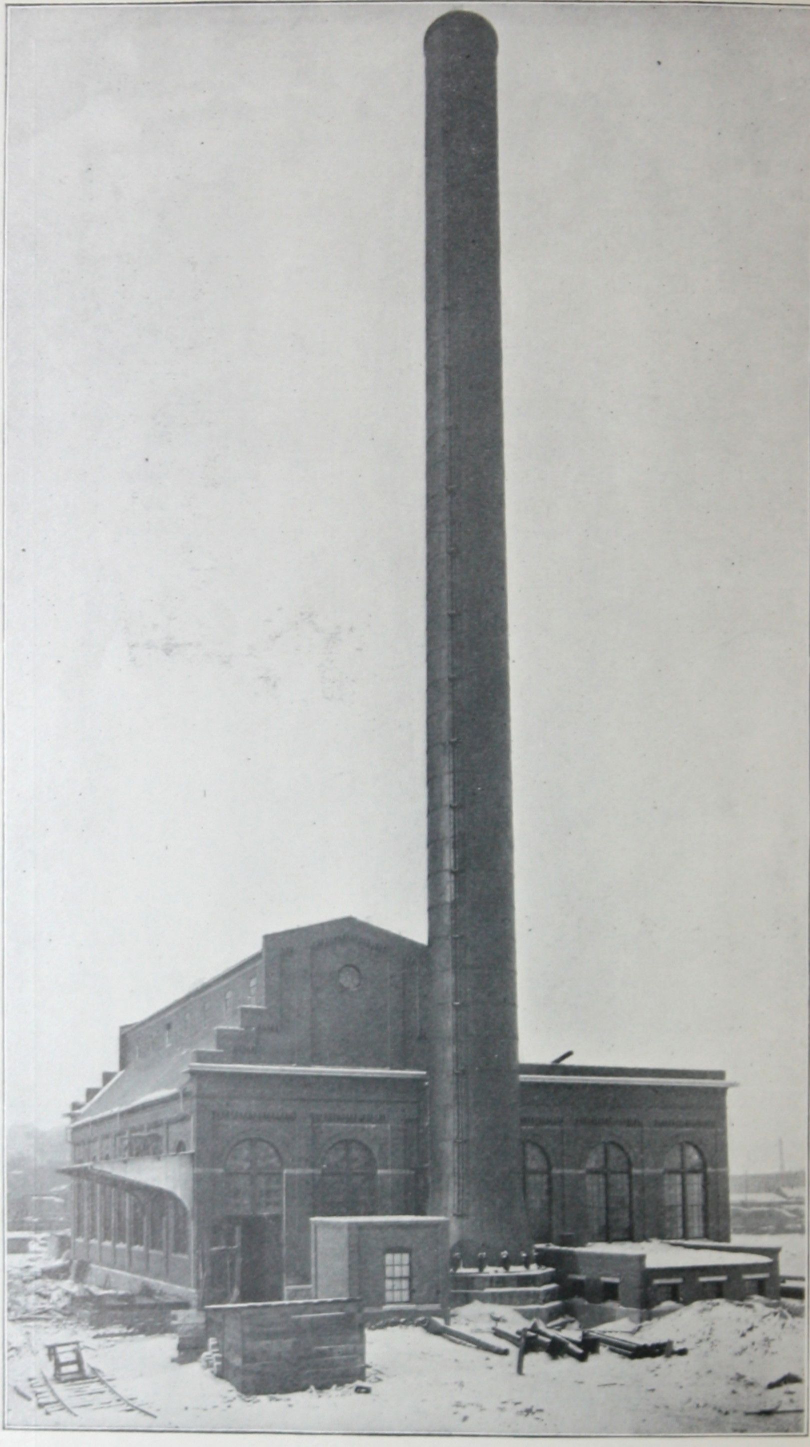
RICHARDS, McCARTY & BULFORD.

Per. C E Richards

CER/C.

Raymond Concrete Piles in foundation of power plant, Union Electric Co., Dubuque, Iowa. Stack foundation piles in the foreground.

Power station of the Union Electric Company, Dubuque, Iowa. Built upon 568 Raymond Concrete Piles.

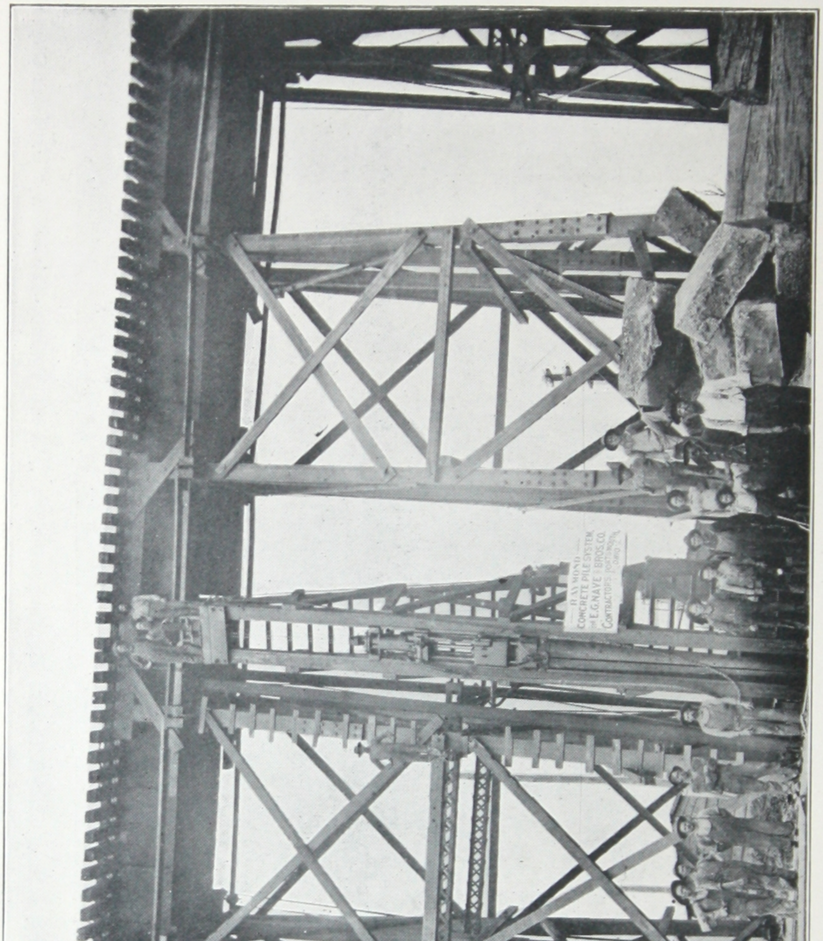


East end of power station of the Union Electric Company, Dubuque. Stack rests upon fifty 20-ft. Raymond Concrete Piles.

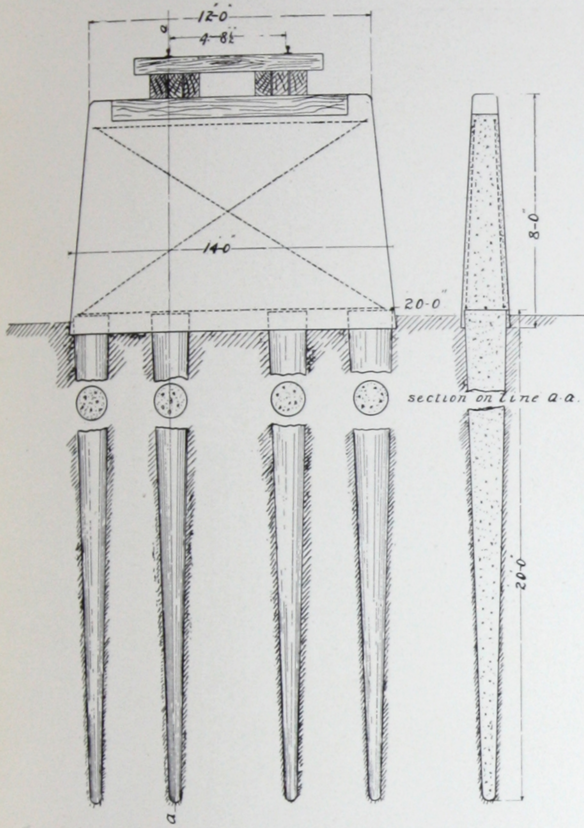
Machinery Warehouse, Chicago, built upon Raymond Concrete Pile foundation early in 1905, in soil of mud, clay and quicksand. No settlement.

Raymond Concrete Piles in foundation of United States Express Co. Bldg., West 23d Street, New York City. Ernest Flagg, Architect.

Building of the United States Express Company, West Twenty-third St., New York City. Ernest Flagg, New York, Architect. Built upon Raymond Concrete Piles.



Placing Raymond Concrete Piles under pedestals of 2,200-foot viaduct of Norfolk & Western Railway at Kenova, W. Va. Work is done without interruption to traffic.
Charles S. Churchill, Chief Engineer.



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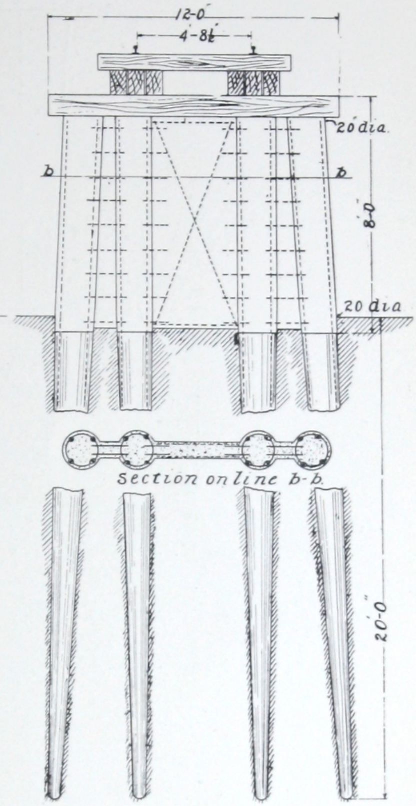

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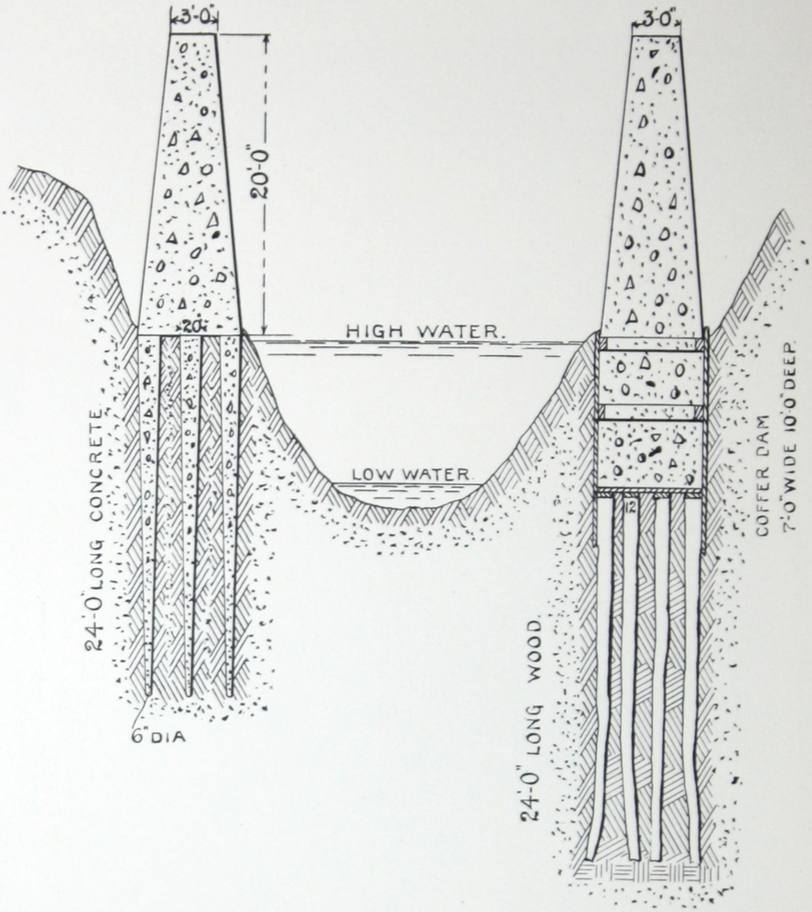
The above illustration shows two designs for concrete pile trestle work.

Fig. 1 Shows Raymond Concrete Piles to the surface of the ground and covered with a reinforced concrete pier.

Fig. 2 Shows reinforced Raymond Concrete Piles extending to desired height of trestle, with wood or concrete cap securely bolted to top of piles. The piles are sway braced with a reinforced concrete web. The piles are 20 in. in diameter from the ground line up. In this construction the reinforcing rods run from near the bottom of the piles to the top, extending into the cap.



Concrete pile foundations for abutments and piers. In abutments, the cofferdam and the excavating and refilling with concrete will be saved, as concrete piles can be driven at any point above low water mark without fear of decay. By their use, work may be begun on the abutment foundation at any time regardless of whether the river or creek is at its highest or its lowest stage.

RAYMOND
CONCRETE
PILING